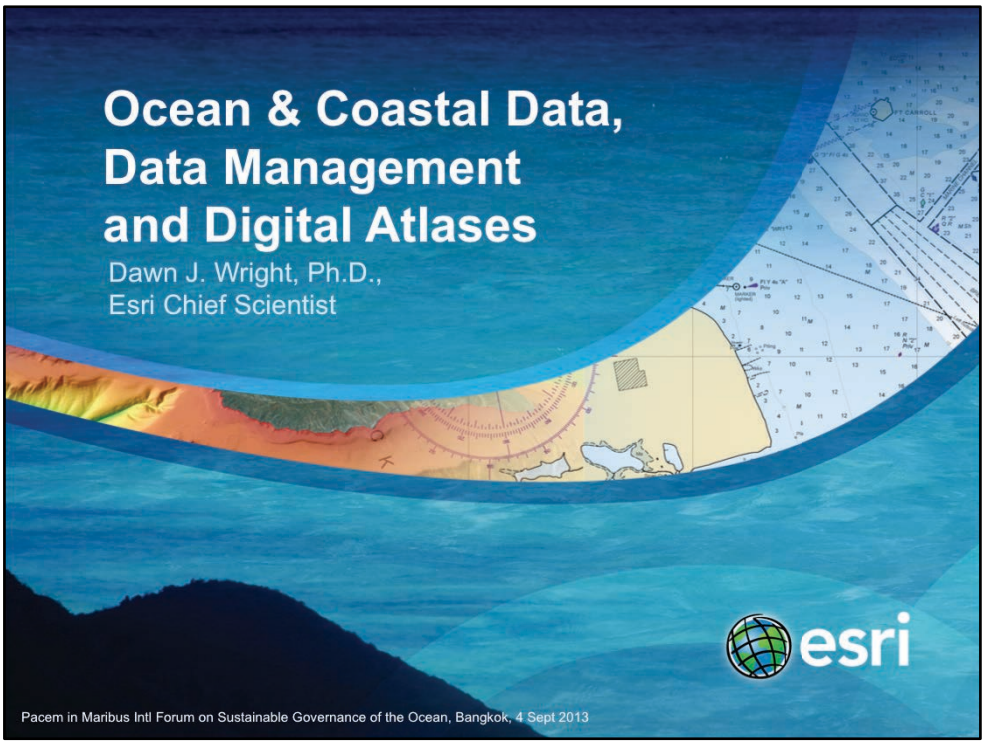


PACEM IN MARIBUS XXXIV: INTERNATIONAL FORUM ON SUSTAINABLE GOVERNANCE OF THE OCEAN

3rd – 8th September 2013

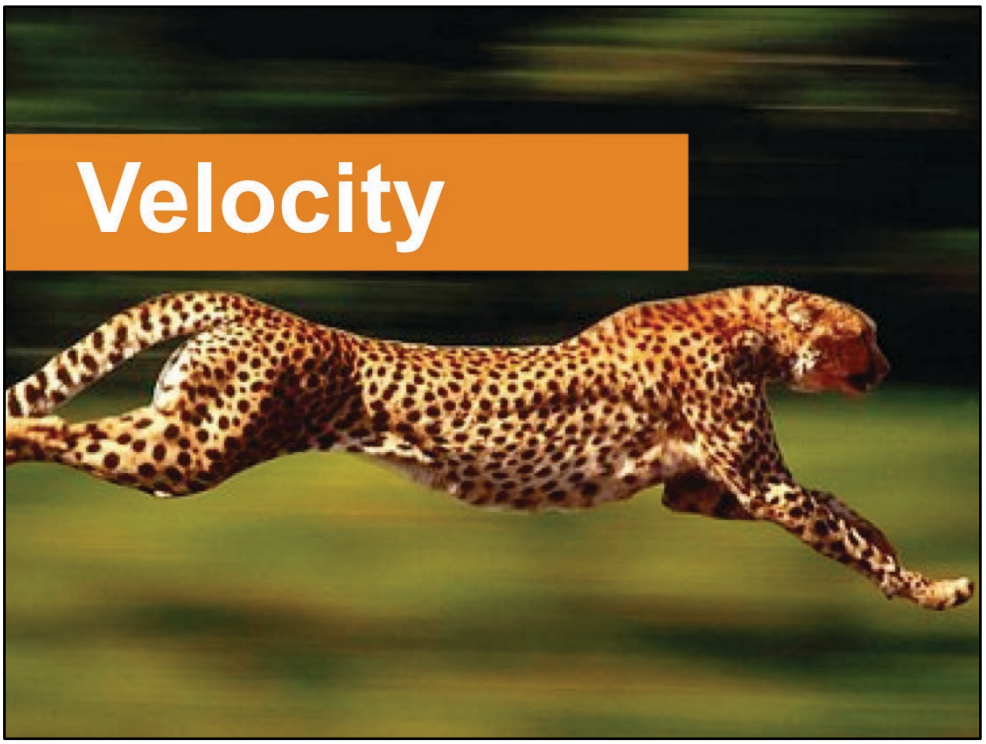
SPECIAL WORKSHOP: INTEGRATED OCEAN WEB-BASED GEOGRAPHICAL INFORMATION SYSTEM

Thursday 5th September, 2013
08:30 – 10:30 hrs ***PARALLEL SESSION*** **Special Workshop: Cluster 2: Technology**

We hear much about the term “big data” in the science literature, in the media, and at conferences, and I think it certainly applies to the Pacem in Maribus discussions.
But what do we really mean by “Big Data” particularly where ocean exploration is concerned?
There are several “tenets” that are being established in the commercial, government, and academic sectors that we will really need to pay attention to as we approach the coming decades.

Size and multidimensional nature of the data, for example with a modern dual head SONAR capturing bathymetry, backscatter and water column, that rate is 115GB/hr. That is approximately a 1.5 Billion to 1 ratio. The analogy is that if you take an ~8mm marble and multiply by the ratio, your marble is the size of the earth (approximately).
That's how MUCH data (shallow) we can capture with modern sonars.
Our sensor count of 2 million + will likely double every 5 years
So the oceans have ALWAYS been about big data, despite how much remains to be explored.

Next 3 images courtesy of Andrew Turner, geoIQ/Esri Washington, DCi R&D Center



So the Gb per HOUR example, leads us to the tenet of VELOCITY or the speed at which data are created and updated, often in near-real time. New challenges for **stream reasoning and rule systems**.
In the world of GIS and mapping we are talking about **30,000 features per SECOND**.
One important question may be which data do we keep?

The VARIETY or structural variability of the data may be the most DELICIOUS and compelling problem for the ocean exploration community.

These are data coming from **multiple sources and types** (photos, video, audio, text, scientific observations, scientific models)**, multiple perspectives** (governments, military, NGOs, IGOs, etc.), which also have **various cultures of contributing data. This was reflected in the pre-forum survey results.**

A single oceanographic survey produces data in scores of different formats. Many physical oceanographic grids and models are **irregularly spaced!**

Not often discussed, but extremely important for the ocean exploration community is a fourth “V” – Veracity. Understanding data provenance, confidence in resulting information

How does one best model uncertainty in big data, especially from citizen science?

Issues of discovery, curation, provenance, organization, integrity.

Wanted to make brief mention of PARTNERSHIPS including with the new world of **ocean DATA/ IT industry** (i.e., public-private partnerships).

Several ocean IT companies including the industry partners on the slide, are members of the World Ocean Council, a unique international BUSINESS alliance for corporate ocean responsibility, collaborating on issues of stewardship of the seas, including multisectoral voluntary ocean obs/ships of opportunity for science, marine spatial planning, and of course improved data infrastructure, sharing for science. As partners, we are all working on different aspects of data science. Marinexplore is even building a marine operating system to streamline big data flows, as well as machine learning tools to improve data quality (e.g., automatically detecting sensor miscalibration, or automatically removing artifacts in ocean satellite data due to cloud cover).

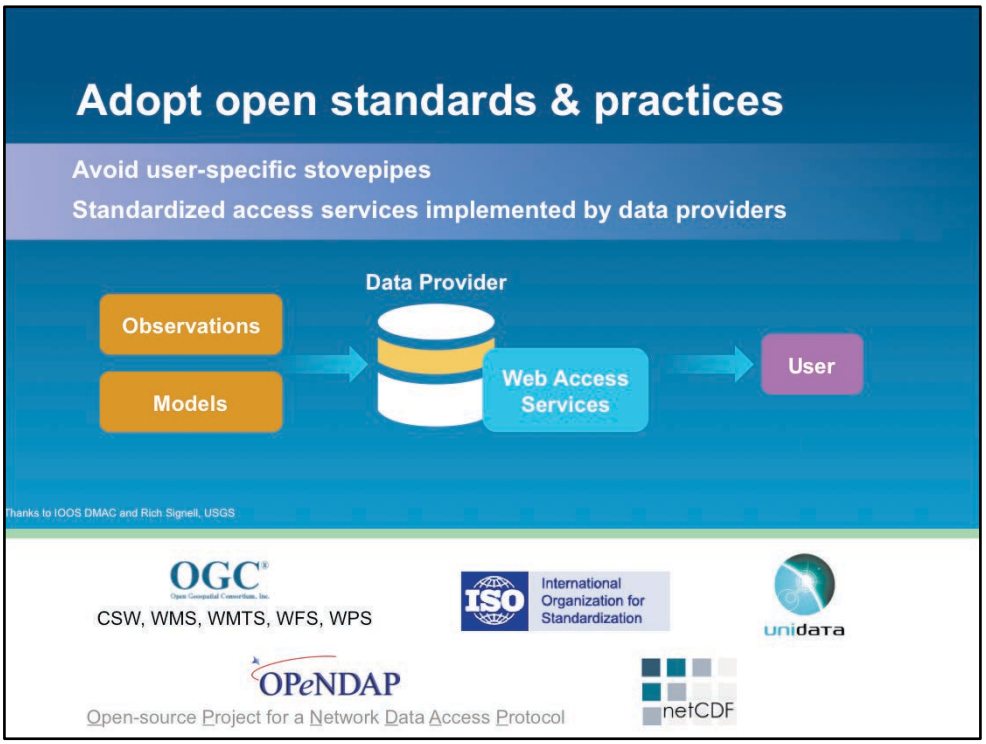
RDA (Research Data Alliance) is fostering public-private partnerships focusing on data use, data quality
From a US National Academy of Sciences Critical Ocean Infrastructure report:
It would be beneficial for federal agencies to periodically examine and adopt data management practices that come from beyond the ocean sciences, as well as approaches to grow access to and use of community-wide facilities. Proven efforts from beyond the ocean sciences can be very informative and helpful.
Community-specific organizations that focus on data use and data quality will also be valuable to the ocean sciences (e.g., NSF EarthCube, AGU Earth and Space Informatics, RDA, etc.)

See the ICAN_Overview.PPT file for more information.

There was interest in the audience about ICAN's handbook of best practices for coastal web atlas implementation. Go to the page http://icoastalatlas.net/handbook to access the chapters.

When you arrive at that page you'll see that some of the chapters have links that allow you to download the content. Other chapters do not, but all you have to do is replace the chapter number that you want for X in the URL below:

http://dusk.geo.orst.edu/ICAN_EEA/Handbook/ChapX.pdf

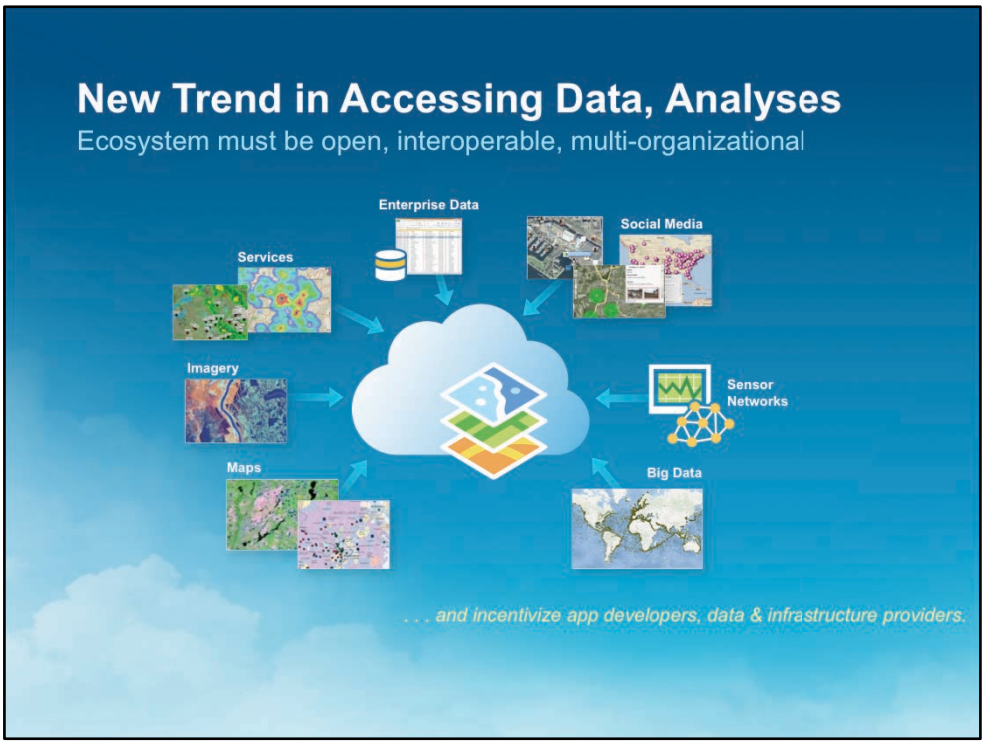


With all the data portals and organizations proliferating, the best approach is to stick to standards
To ensure that we are as nimble and effective as possible as we interoperate among **data formats, conventions, vocabularies, data files, data access portals, data catalogs, organizations.**

Open-source Project for a Network Data Access Protocol
WMTS = Web Map Tile Service with REST, SOAP, key-value-pairs encodings - http://en.wikipedia.org/wiki/Web_Map_Tile_Service

Currently no formal, accredited academic degree or curricula
in ocean data management!

Given the importance of data science to ocean exploration, this is something that we need to fix! UNESCO IODE OceanTeacher provides resources as a start.



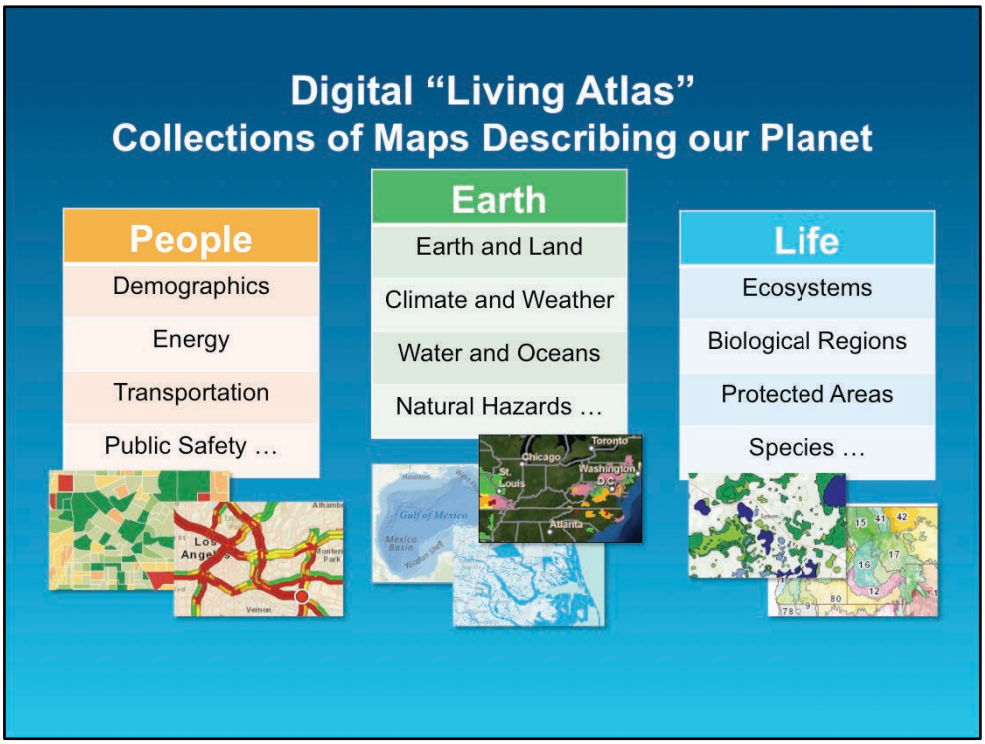
We are moving from an age where people are buying separate pieces, the hardware, the data, the software, etc., to a new trend of SaaS (software as a service) and other services

Stop moving data, push algorithms TO the data.

- subscription models are taking hold
- ecosystem must be open, interoperable, multi-organizational in its nature with multiple revenue streams that incentivize
    - app developers
    - data providers
    - infrastructure providers (e.g., Amazon, Microsoft)

http://esri.github.io/gis-tools-for-hadoop/

Dawn mentions in Q/A the emergence of DATA APPLIANCES that provide data, services, an INTRAnet for small communities that have difficulty getting on the global Internet. Esri is experimenting with these approaches, trying to provide such infrastructure as appropriate.



Esri's concept of a "Living Atlas"

ArcGIS Includes a *Living Atlas* of the World

Maps and Layers from Esri and Thousands of Contributors

Elevation
Hydro
Habitats
Hazards
Streets
Oceans
Places
Dynamic Imagery
Landscape
Demographics
Energy
Imagery

Growing Collection includes Crowd Sourcing

. . . Providing a Foundation for 1000s of Projects

ArcGIS as a Living Atlas:

Well-organized collection of maps, data, apps through ArcGIS.com.

ArcGIS as a Living Atlas:

Best available maps from authoritative sources.

ArcGIS as a Living Atlas:

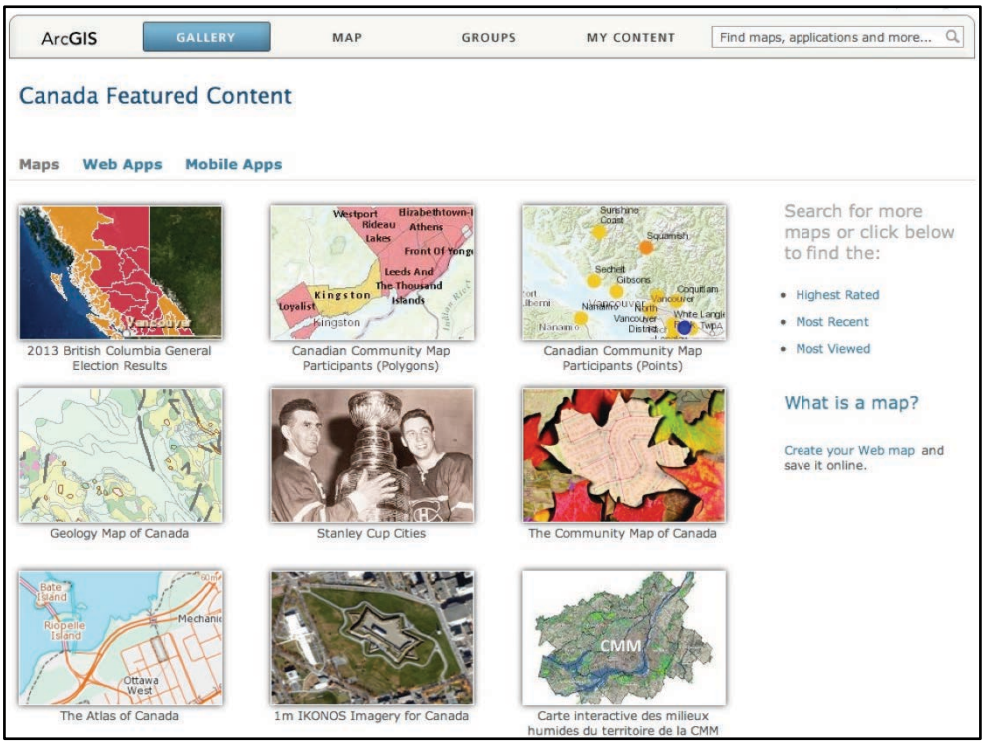
Curated by Esri and a global community of participants.

ArcGIS as a Living Atlas:

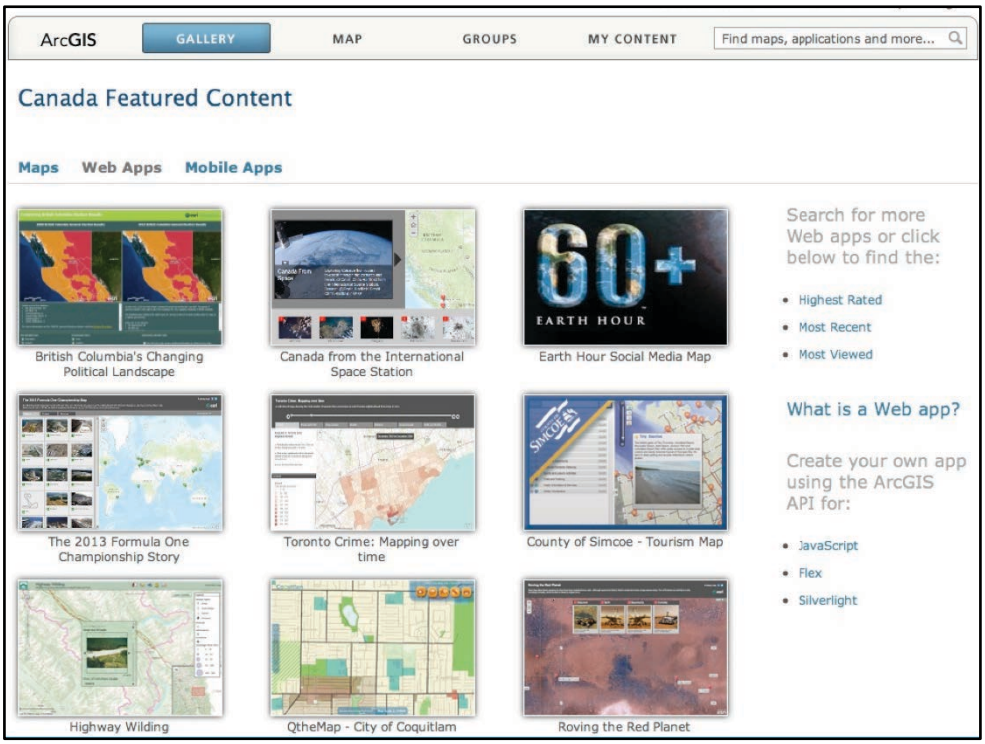
Continuously growing, evolving, and updating.

ArcGIS as a Living Atlas:

Free at arcgis.com/home + more content available by subscription.



Example here from Canada but works for an country that one access arcgis.com from where local content is shown for that country.


ArcGIS
GALLERY
MAP
GROUPS
MY CONTENT
Find maps, applications and more...
Canada Featured Content
Maps
Web Apps
Mobile Apps
British Columbia's Changing Political Landscape
Canada from the International Space Station
60+
EARTH HOUR
Earth Hour Social Media Map
Search for more Web apps or click below to find the:
Highest Rated
Most Recent
Most Viewed
The 2013 Formula One Championship Story
Toronto Crime: Mapping over time
County of Simcoe - Tourism Map
What is a Web app?
Create your own app using the ArcGIS API for:
JavaScript
Flex
Silverlight
Highway Wilding
QtheMap - City of Coquitlam
Roving the Red Planet

ArcGIS
GALLERY
MAP
GROUPS
MY CONTENT
Find maps, applications and more...
Canada Featured Content
Maps
Web Apps
Mobile Apps
QuakeFeed iOS App
GeoMobile for ArcGIS
Banff Pothole Reporter
Search for more mobile apps or click below to find the:
Highest Rated
Most Recent
Most Viewed
REGINA
City of Regina CityApp
ArcGIS for iOS Application
ArcGIS for Windows Phone
What is a mobile app?
Create your own mobile app using the ArcGIS SDK for:
iOS
Mobile
Windows Phone
Android
BAO for iOS
ArcGIS for Android App
APOS Location Intelligence Playbook

ArcGIS as a Living Atlas:

Free at arcgis.com/home + more content available by subscription.

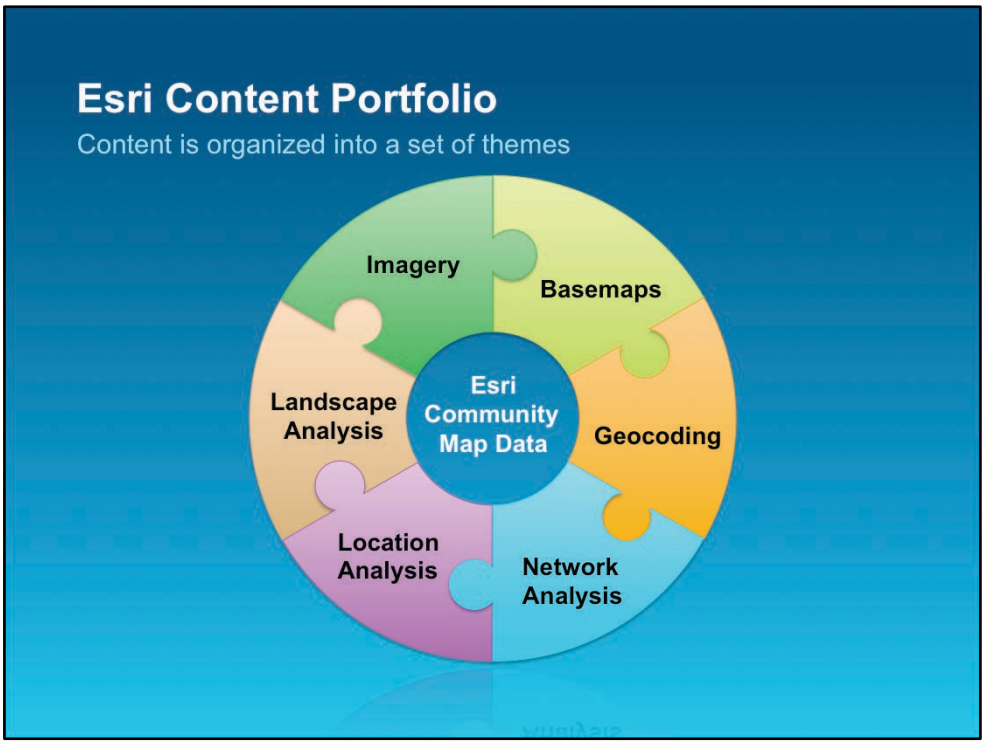
Examples of ArcGIS Online for Organization sites, where users have taken customized ArcGIS Online to meet their needs of their own government agency, organization, institute, or university. The user has complete control and can store data, maps, and apps on Esri's cloud (where Esri provides all admin, backups, and security), or their own private clouds. AGOL for Organizations essentially represents an "Atlas in a Box" because everything that is needed is there in a package for the user already. Just add data and stir.

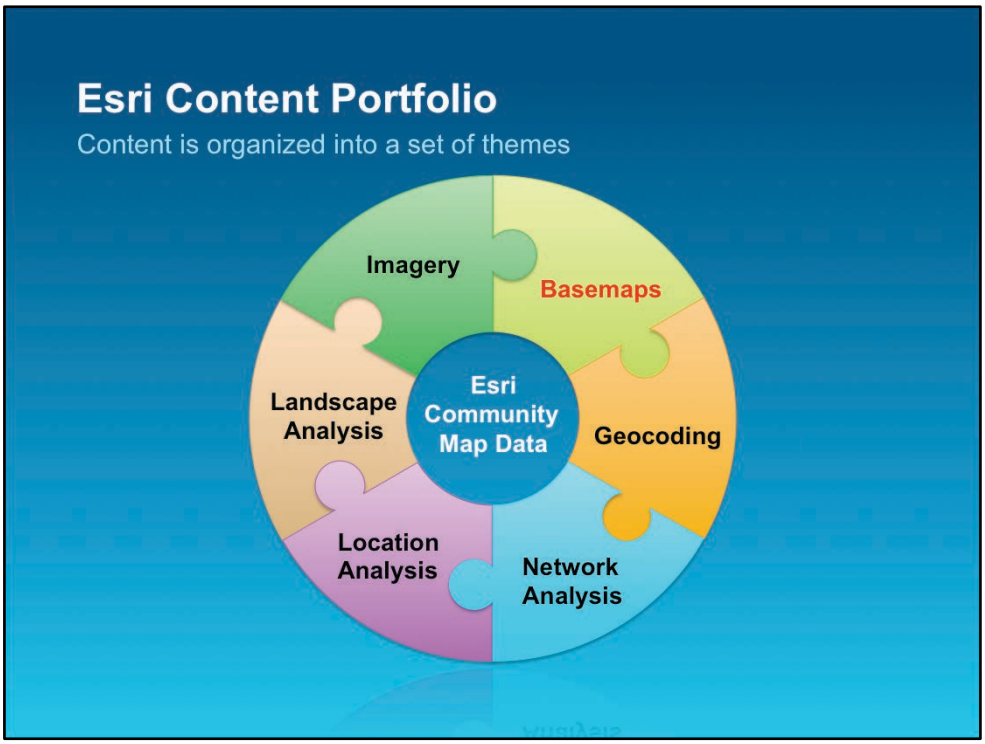
wadnr.maps.arcgis.com

coagis.maps.arcgis.com

Resource Center
Show: Web Content Only
Help
Sign In
HOME
GALLERY
MAP
GROUPS
MY CONTENT
Find maps, applications and more...
EYEonEARTH
eyeonearth.maps.arcgis.com
NETWORK
Welcome!
Eye on Earth is a global public information service.
Westland
Naaldwijk
Hoekse Bosjes
Hook of Holland
Staeldijnse Bosch
Heat wave risk of European cities
Hermione mapbook: Human impacts in deep-
ImaginAir photo competition finalists
Marine Diversity and Protection - Abu Dhabi
Eye on Earth is the result of a public-private partnership joining expertise from industry and public organisations.
Make a Map »
Create a map that can be viewed in a browser, desktop or mobile device. Share it on a blog, via email, or embed it in a website.
ArcGIS for Developers »
Build custom web and mobile applications that incorporate your maps and data.

The content available in the ArcGIS system is provided by Esri (with support from its partners) and the ArcGIS user community.


Esri Content Portfolio
Content is organized into a set of themes
Imagery
Basemaps
Landscape Analysis
Esri Community Map Data
Geocoding
Location Analysis
Network Analysis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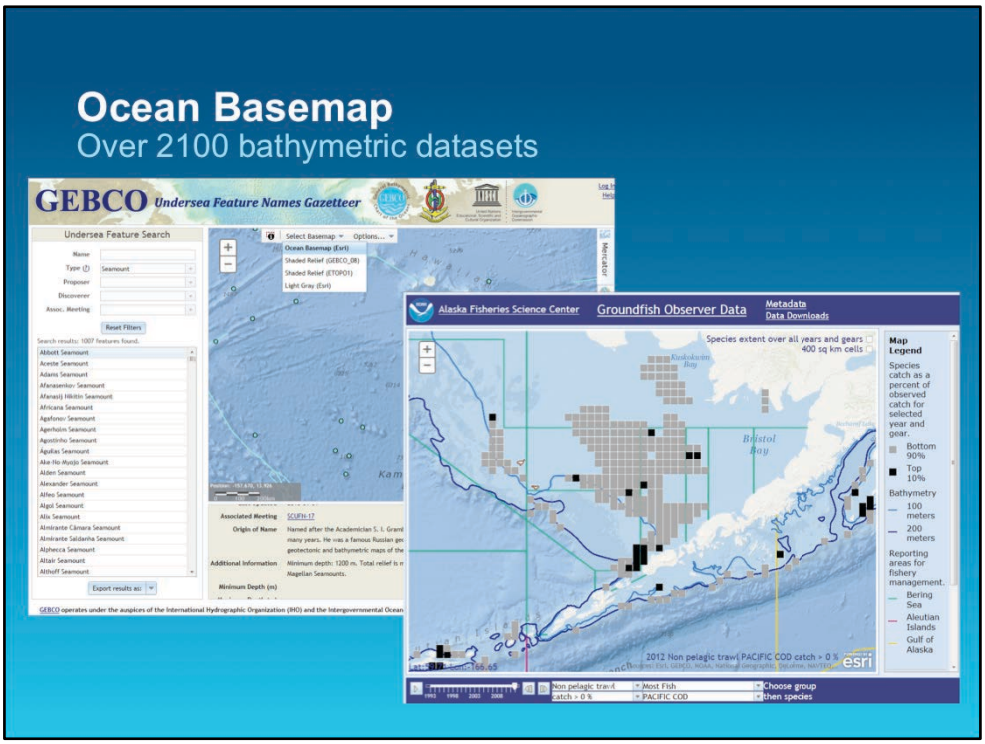
Basemaps

Suite of basemaps to support web maps and applications

Reference and Foundation Maps for a Living Atlas



One of our biggest contributors to the Ocean Basemap is NOAA, which contributed bathymetric data as for all US coastal areas, as DEMs. This allows us to get zoom coverage down to 1:72K. They also contributed bathy data as bathymetric attributed grids (BAG), and for these select areas we are able to get zoom coverage down to 1:9K, but coverage is limited. We've included all of these data, and continue to update with NOAA data as more grids become available.

The basemap is used widely across the NOAA organization, as the basemap backdrop (lower right). The upper left example is a NOAA/GEBCO site that is responsible for the global gazetteer of undersea feature names. It's also a 'door opener' for the parts of the organization that are using open source.

Here are some more examples of the Ocean Basemap in Use.

- NOS NCCOS Bio Geo program Story map on mapping coral reefs .. http://maps.coastalscience.noaa.gov/storymap/storymap.html?story=mappingsummaryreport
- NROC, Northeast Regional Data Portal http://northeastoceanviewer.org/
- NOAA / BOEM MarineCadastre.gov http://csc.noaa.gov/mmcviewer/
- NOS CSC ENOW (Economic Application) http://www.geoplatform.noaa.gov/home/webmap/viewer.html?webmap=89c9a6c716c04543935ee8097163901c

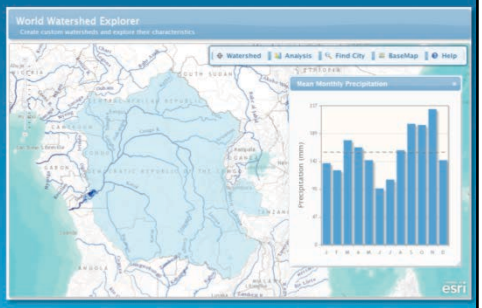
Community Maps Program - Data

- Popular map themes
  - World Topographic Map
  - World Imagery
  - World Street Map
  - Ocean Basemap
- *New map themes*
  - Hydro-conditioned elevation
  - Precipitation
  - Soils

In the spirit of crowdsourcing/VGI of authoritative content from the community that Esri then hosts free in the cloud and for which you **retain ownership** and for which you are **acknowledged.**

Community Maps Program - Analysis

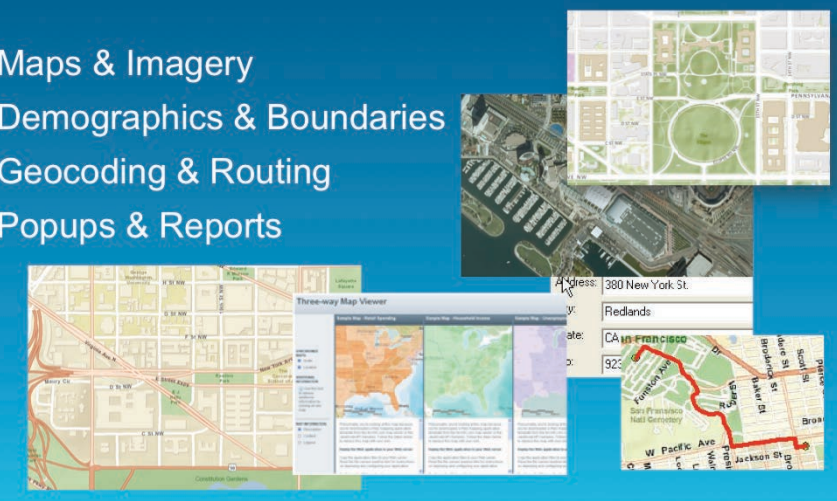
- Current analysis services
  - Geocoding
  - Routing
  - Service area
- *New analysis services*
  - Flow Direction
  - Flow Accumulation
  - Synthetic Steam Network
  - *Watershed Delineation*
  - *Upstream/Downstream Tracing*
  - *Descriptive Statistics*
  - *More …*

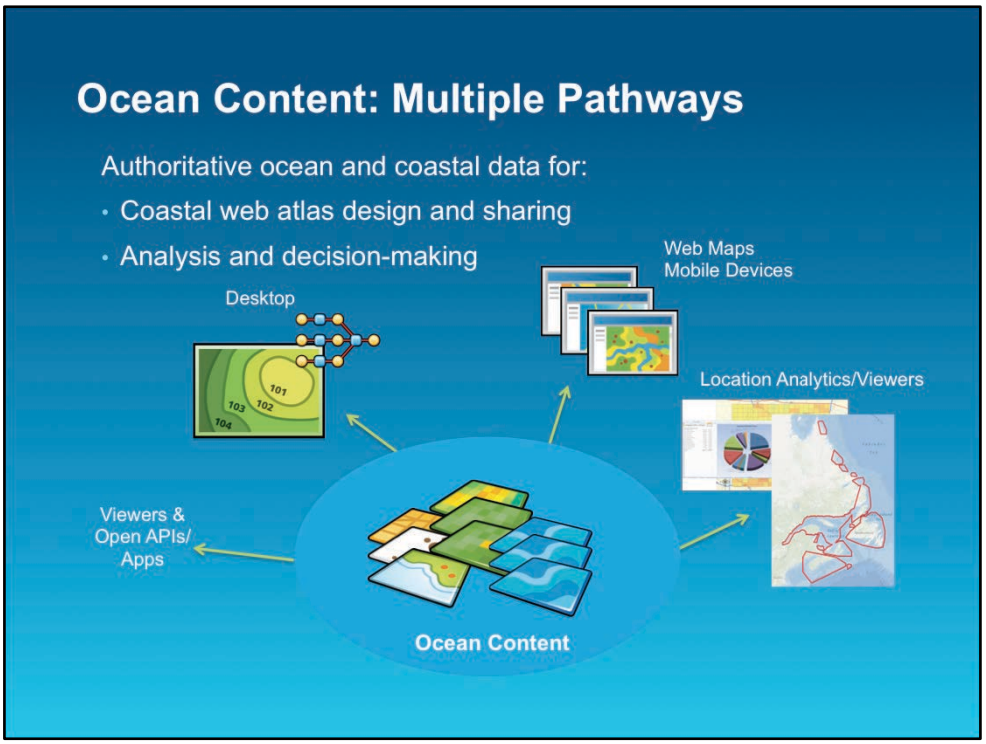


Broader Esri Content

A collection of ready-to-use maps, data layers, and tools

- Maps & Imagery
- Demographics & Boundaries
- Geocoding & Routing
- Popups & Reports



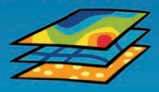


A modest proposal: With existing coastal web atlases or digital atlases, with all the effort that has gone into them, leverage your most popular layers even FURTHER by mirroring or publishing in ArcGIS Online to expose your data and your atlas to a broader community of users. The idea is to drive new users from ArcGIS Online BACK to your site. Or for those just starting with atlas development, such as the IOI, consider ArcGIS Online for Organizations (which may be available for free or extremely low cost if your university or agency already has an Esri site license.

In Q and A Dawn mentioned the possibility of a free “jump start” package for the IOI where Esri could lead IOI through the initial steps, provide the initial infrastructure. This is a discussion for later, and Dawn would be happy to provide connections with appropriate Esri personnel.

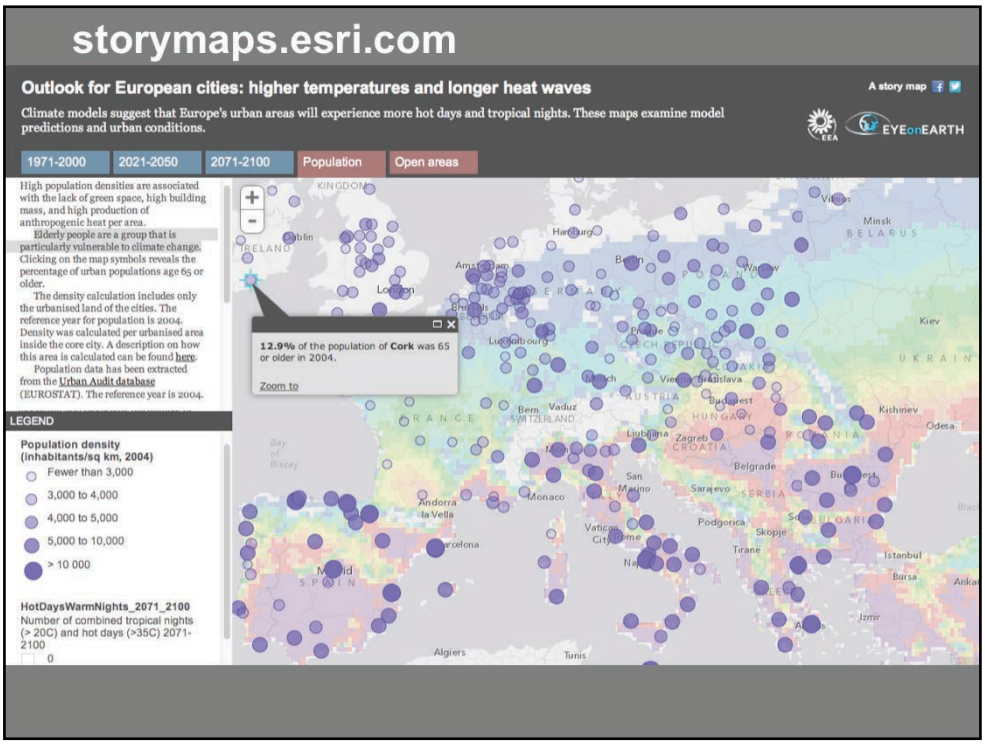
Example Themes and Layers

1. Physical Oceanography
   (currents, temp, weather and sea-state, etc.)
2. Biological
   (species, animal tracks, benthic habitat, marine protected areas)
3. Risk Assessment / Planning
   (resilience, vulnerability, coastal/ocean health index)



4. Political / Cultural
   (political boundaries and admin, historically important places)
5. Economic
   (navigation, transportation, fisheries, aquaculture, hazards, etc.)

Some in the coastal web atlas community are interested in leveraging open source code and solutions along with Esri technology, so these resources should be of great help.



Story map coupling climate model predictions of hot days and warms nights with population density throughout Europe. Given that elderly people are particularly vulnerable to climate change, clicking on a map symbol shows what percentage of the population was 65 or older in 2004.

Original EEA source map at http://bit.ly/Z7973Q

Thank You
Dawn Wright
dwright@esri.com
Twitter: @deepseadawn

Extra Slide

We used the Apple iBook approach. What is an iBook ?
iBook is an iOS (iPhone and iPad) application that can be used to view interactive books published using the iBook Author (A Mac only application that can be downloaded for free on the Mac App store). iBooks can have interactive elements like gallery of images, videos, reviews, 3D models and any kind of HTML5 widget embedded.

Why did we use an iBook for this Atlas ?
We had this amazing data about Mexico along with lots of photos and information. Anything thats linear in the workflow like a impress or a presentation would have dampened the knowledge and hence we created an Atlas where people could move back and forth between the contents very easily. iBooks author was simple to use and had a lot of options to customize the way we wanted to show the data.

How are the Esri maps embedded in the iBook ?
iBooks can embed HTML5 widgets within the pages. That gives an option to embed the web maps created on ArcGIS online as an interactive content in the map. We created a template of the widget and started replacing the URL s for the different maps for each topic or page.

What do we need to create our own iBook ?